

## REMARKS

Favorable reconsideration is respectfully requested in view of the foregoing amendments and following remarks.

Claim 17 has been revised to independent form and to further incorporate the feature of claim 16 into claim 17.

Claim 21 has been revised in independent form.

Claims 15, 16, 19, 20, 28-34 and 37 are cancelled without prejudice.

The dependencies of claims 18, 22, 23, 25, 26, 35 and 36 have been amended accordingly.

The Applicants have noted that the term “an average fiber diameter” appearing in claims 17, 23 and 24 should read “a fiber diameter”. The fiber diameter range defined in claims 23 and 24 covers that of the commercially available non-woven fabric employed in the working examples (e.g. DuPont Tyvek<sup>TM</sup>). However, the term “average fiber diameter” is not commonly used to specify fiber diameters of commercial available non-woven fabric products.

Claims 23 and 24 have accordingly been amended by deleting the word “average” therefrom.

Please note that the new range of “fiber diameter” falls within the original range of “average fiber diameter”. Thus, this amendment does not result in broadening of the numerical range recited in the amended claims.

Turning to the Official Action, claims 19-34, 36 and 37 are rejected under 35 USC 112, second paragraph, as being indefinite for omitting essential structural cooperative relationships of the elements.

Claim 21 has been amended to recite that the fiber membrane material and the micro porous membrane material are laminated together. Support for the amendment is found in the specification at page 17, lines 26-35.

Accordingly, this ground of rejection is deemed to be overcome.

Claims 15-18 and 35 are provisionally rejected on the ground of non-statutory obviousness-type double patenting as being unpatentable over claims 11-19 of co-pending application No. 10/554,585.

The Applicant has decided to allow the co-pending U.S. application to go abandoned. Accordingly, this provisional ground of rejection is deemed to be overcome.

Claims 19-22, 25-29, 32-34, 36 and 37 are rejected under 35 USC 102 as being anticipated by, or under 35 USC 103 as being obvious over, JP 2000-254456. This ground of rejection is respectfully traversed as applied to the amended claims.

By the amendment, claim 19 is cancelled, and claims 20 and 21 are combined. Further, all of the rejected sub-claims are made dependent on claim 21.

The Examiner states that the filter cartridge disclosed in this JP reference comprises a micro porous layer, as well as a fibrous membrane layer, and also that the base materials disclosed in the reference are all hydrophilic.

In fact, the above-mentioned JP reference teaches that the materials of the micro porous membrane layer should be highly heat-resistant or highly chemical proof, like fluorinated resins (e.g. polytetrafluoroethylene, polyfluorovinylidene); polysulfone polymers (e.g. polyethersulfone and polyphenylenesulfone); or polyolefins (e.g. polyethylene and polypropylene).

However, the same reference does not teach or suggest the introduction of hydrophilic functional groups into the micro porous membrane materials.

In Examples 1 and 2 of the JP reference, it is found that polysulfone and polyethylene are used as a material of the micro porous membrane, respectively.

It should be noted that the above-mentioned micro porous membrane materials do not comprise any hydrophilic functional group.

It is obvious to one of ordinary skill in the art that polyolefins and fluorinated resins do not have any hydrophilic group, and also that they are all hydrophobic, rather than hydrophilic.

With respect to polysulfones, there is enclosed for the Examiner's reference a copy of page 946 of the Kirk-Othmer Encyclopedia of Chemical Technology, 4<sup>th</sup> edition, Volume 19, in which the chemical structures of the typical polysulfones are illustrated. From the illustrated chemical structures, it is clear that polysulfones do not have any hydrophilic group.

In view of the foregoing, the JP reference fails to teach or suggest the use of the micro porous membrane material having a hydrophilic group as one of the laminated elements of the claimed filter cartridge.

Therefore, the claimed invention is patentable over JP 2000-254456.

Lastly, claims 15-16, 18-20, 22-27 and 29-37 are rejected under 35 USC 102 as anticipated by, or in the alternative under 35 USC 103 as being obvious over, U.S. Patent No. 4,828,698. This ground of rejection is respectfully traversed as applied to the amended claims.

Claims 15-16, 18-20 and 29-37 are rejected as not being patentable over Jewell et al., whereas claims 17 and 21 are not rejected.

To overcome this rejection, claims 15-16 and 17 have been combined and claims 20-21 have been combined by this amendment.

Accordingly, the rejection based on Jewell et al. has been overcome.

In view of the foregoing, it is believed that each ground of rejection set forth in the Official Action has been overcome, and that the application is now in condition for allowance. Accordingly, such allowance is solicited.

Respectfully submitted,

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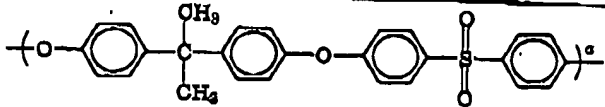
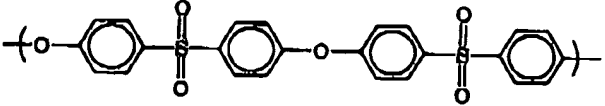
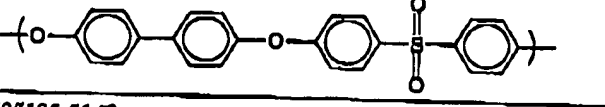
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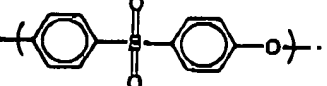
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the choice of bisphenol. There are three commercially important polysulfones referred to generically by the common names polysulfone (PSF), polyethersulfone (PES), and polyphenylsulfone (PPSF). The repeat units of these polymers are shown in Table 1.

Table 1. Chemical Structures and Glass-Transition Temperatures,  $T_g$ , of PSF, PES, and PPSF

Polymer	Repeat unit structure	$T_g$ , °C
polysulfone		185
polyethersulfone <sup>b,c</sup>		220
polyphenylsulfone <sup>d</sup>		220

<sup>a</sup>Bisphenol A polysulfone [25136-61-7].  
<sup>b</sup>PES repeat unit structure can alternatively be drawn as .  
<sup>c</sup>Victrex polyethersulfone [25667-42-9].  
<sup>d</sup>RADEL R polyphenylsulfone [25608-64-4].

## Polymerization

**Nucleophilic Substitution Route.** Commercial synthesis of poly(arylethersulfone)s is accomplished almost exclusively via the nucleophilic substitution polycondensation route. This synthesis route, discovered at Union Carbide in the early 1960s (8,4), involves reaction of the bisphenol of choice with 4,4'-dichlorodiphenylsulfone in a dipolar aprotic solvent in the presence of an alkali base. Examples of dipolar aprotic solvents include *N*-methyl-2-pyrrolidinone (NMP), dimethyl acetamide (DMAc), sulfolane, and dimethyl sulfoxide (DMSO). Examples of suitable bases are sodium hydroxide, potassium hydroxide, and potassium carbonate. In the case of polysulfone (PSF) synthesis, the reaction is a two-step process in which the dialkali metal salt of bisphenol A (1) is first formed *in situ* from bisphenol A [80-05-7] by reaction with the base (eg, two molar equivalents of NaOH), followed by the nucleophilic substitution reaction of (1) with 4,4'-dichlorodiphenylsulfone [80-07-9] (2). Polysulfone is typically prepared as described in Reference 5 according to equation 1 where  $n = 40-60$ . The minimum degree of polymerization is dictated by the minimum molecular weight required to achieve useful mechanical properties from the polymer. For polysulfone, this corresponds to a reduced viscosity of about 0.35 dL/g (in chloroform at 25°C and 0.2 g/dL concentration).

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